C. 1

simpson

MODELS 712/713
UNIVERSAL COUNTERS

Professional Series

SIMPSON ELECTRIC COMPANY
853 DUNDEE AVENUE, ELGIN, ILLINOIS 60120
PHONE: (708) 697-2260

DIGITAL INSTRUMENT WARRANTY

SIMPSON ELECTRIC COMPANY warrants each digital instrument manufactured by it to be free from defects in material and workmanship under normal use and service. Its obligation under this warranty being limited to making good at its factory any instrument which shall within one (1) year after delivery of such instrument to the original purchaser be returned intact to it, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective, this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any digital instrument which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

SIMPSON ELECTRIC COMPANY
853 Dundee Avenue, Elgin, Illinois
(708)697-2260 • Telex 72-2416 • FAX (708)697-2272
IN CANADA: Bach-Simpson, Ltd., London, Ontario

Printed in U.S.A
Edition: 1st

Part No. 6-114726

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OPERATOR'S MANUAL

MODELS 712/713 UNIVERSAL COUNTERS

WARNING

READ AND UNDERSTAND THIS MANUAL BEFORE USING THE INSTRUMENT.

Failure to understand and comply with the WARNINGS and operating instructions can result in serious or fatal injuries and/or property damage.

SAFETY INFORMATION

WARNING

This Instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with a Simpson 0-500 DC microammeter and use this as the measuring instrument.

SAFETY SYMBOLS

This marking adjacent to another marking or a terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid damage to the equipment and/or personal injury.

WARNING

This **WARNING** sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly performed or adhered to, could result in personal injury.

CAUTION

This **CAUTION** sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly adhered to could result in damage to or destruction of part or all of the instrument.

GROUNDED TERMINAL (PROTECTIVE):

A terminal which is connected to earth ground for personal protection from electrical shock.

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Figure 1-1. Model 713 Universal Counter

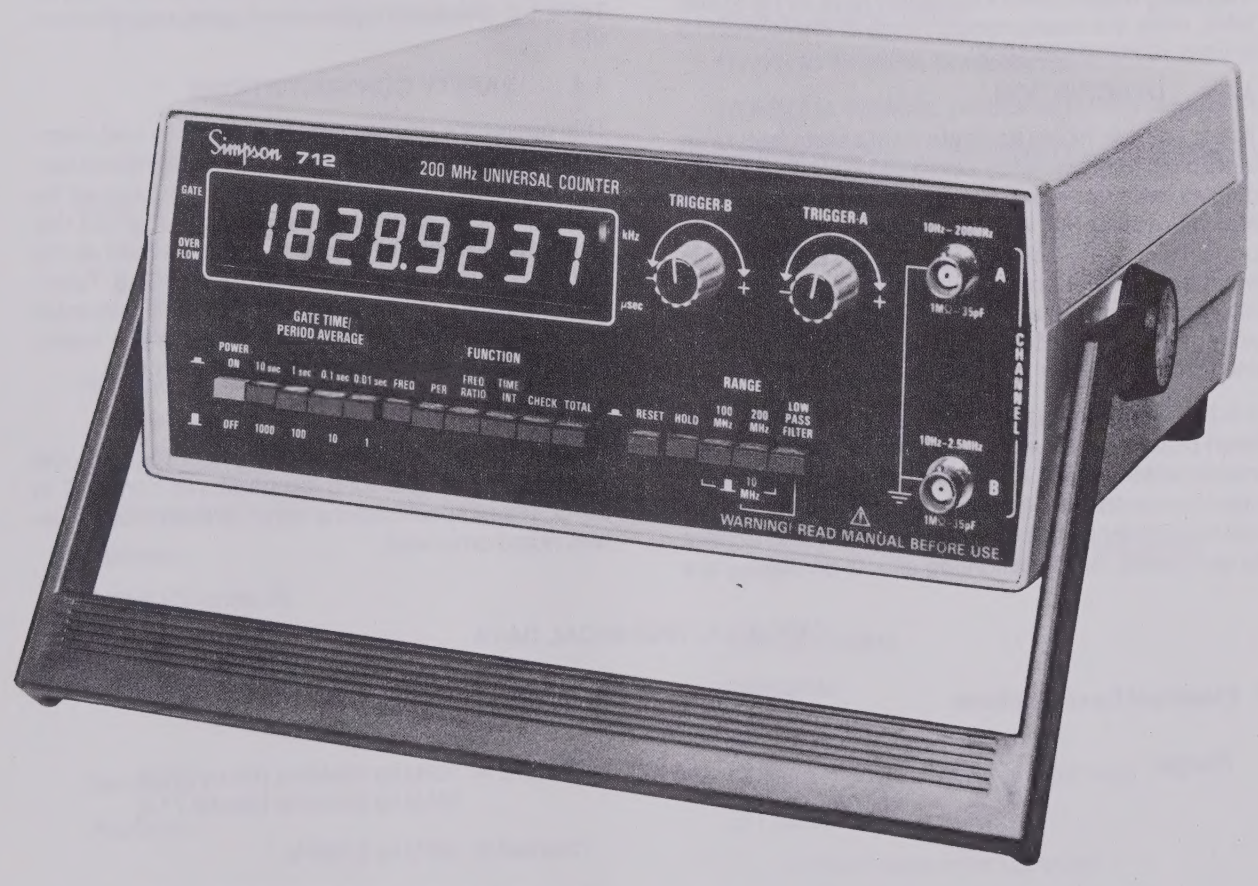


Figure 1-2. Model 712 Universal Counter

SECTION I

INTRODUCTION

1.1 GENERAL

The Simpson Models 712/713 Universal Electronic Counters (hereafter referred to by model number or the Instrument), are highly accurate, versatile, general purpose electronic counters suitable for use in laboratory, production, servicing, and in digital systems for industrial controls. Specifically, the Instrument is intended for any use where frequencies, periods, ratios of two frequencies, time intervals, or events are to be measured. The Model 712 provides frequency measurement capability from 10 Hz to 200 MHz, while the measurement range of the Model 713 is from 10 Hz to 520 MHz.

1.2 DESCRIPTION.

1.2.1 These highly accurate Instruments feature an eight digit, high efficiency seven segment orange LED display, with Overflow, Gate, KHz and μs indicators. Maximum reliability, with a minimum number of components, is achieved by using a single LSI circuit for most of the functions. The Instrument maintains its rated accuracy over a wide temperature range and line voltage variations. Both models can operate from a line voltage of either 120 VAC or 220 VAC.

1.2.2 Components in the electronic counter have been placed for ease of maintenance and increased instrument durability. Except for panel controls, all circuit components are mounted on only two printed circuit boards for both instrument reliability and access to test points. Ambient lighting effects on display are minimized by a filter which reduces reflections and background illumination. With simplified switch and control nomenclature, operator errors are reduced to a minimum. Personnel with little experience with an instrument of this type can obtain quick and accurate measurements with minimum training.

1.3 SUPPLIES AND ACCESSORIES

All supplies and accessories required for the operation of the Instrument are furnished and are listed in Table 1-2. (Available replacement parts are in Section VI.)

1.4 SAFETY CONSIDERATIONS

This operator's manual contains cautions and warnings alerting the user to hazardous operating and servicing conditions. The information is flagged by CAUTION and WARNING headings throughout this publication where applicable, and is defined at the front of the manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel and to retain the operating conditions of the Instrument, these instructions must be adhered to.

1.5 TECHNICAL DATA

Table 1-1 lists the technical data for both the Model 712 and 713 at operating temperatures from 0°C to 50°C. These specifications apply to both models unless noted otherwise.

TABLE 1-1. TECHNICAL DATA

1. Electrical Specifications

Range:	Channel A: 10Hz to 100MHz (Model 713) 10Hz to 200MHz (Model 712)
	Channel B: 10Hz to 2.5MHz
	Channel C: 100MHz to 520MHz (Model 713)
Sensitivity:	Channel A: 25mV rms, 10Hz to 10 MHz
	50mV rms, 10 MHz to 100 MHz
	100mV rms, 100MHz to 200MHz (Model 712)
	Channel B: 25mV rms, 10 Hz to 2.5MHz
	Channel C: 100mV rms, 100MHz to 520MHz (Model 713)

Coupling:	AC
Low Pass Filter:	Channel A: 3dB at 150KHz
Impedance:	Channels A and B:1MΩ nominal shunted by 30 pf
	Channel C: 50Ω (Model 713)
Maximum Input Voltage:	Channels A and B: 120V rms
	Channel C: 3V rms (Model 713)

2. Frequency

Channel A:	10Hz to 10MHz, Direct
	10MHz to 100MHz, prescaled by 10
	100MHz to 200MHz, prescaled by 100 (Model 712)
Channel C:	100MHz to 520MHz, prescaled by 100 (Model 713)
Gate Time:	Selectable
Direct:	0.0l sec, 0.1 sec, 1.0 sec, 10 sec
Prescaled by 10:	0.1 sec, 1.0 sec, 10 sec
Prescaled by 100:	1.0 sec, 10 sec
Resolution:	
Direct:	0.1Hz, 1.0Hz, 10Hz, 100Hz
Prescaled by 10:	1.0Hz, 10Hz, 100Hz
Prescaled by 100:	10.0Hz, 100Hz
Accuracy:	±1 count ± (time base error x frequency)

3. Period (Channel A)

Range:	10Hz to 2.5MHz
Period Average:	Selectable
	x1, x10, x100, x1000
Resolution:	0.1 nsec, 1.0 nsec, 10 nsec, 100 nsec
Accuracy:	± 1 count ± trigger error
	± (time base error x period)

4. Frequency Ratio
(Input A ÷ B)

Range:	10Hz to 10MHz Channel A
	10Hz to 2.5MHz Channel B
Resolution:	± 1 count ± (B trigger error x Frequency A)/N where N = 1, 10, 100, 1000
Accuracy:	± 1 count ± (B trigger error x Frequency A)/N

5. Time Interval
(Input A to Input B)

Range:	.5 μs to 200,000 μs
Sensitivity:	1V peak at minimum pulse width of .5μs
Time Internal Average:	Selectable
	x1, x10, x100, x1000
Resolution:	0.1 nsec, 1 nsec, 10 nsec, 100 nsec
Accuracy:	± 1 count ± A trigger error ± B trigger error ± (time base error x time interval)

6. Totalize (Channel A)

Range:	10Hz to 10MHz
Resolution:	± 1 count of input

7. Self Check — Checks and displays the internal time base oscillator frequency (10MHz).

8. General Specifications

Display:	8 digit, .56" High, Orange LED display with Overflow, Gate, KHz and μs indicators
Operating Temperature:	0°C to 50°C
Storage Temperature:	-40°C to 70°C
Time Base:	
Frequency:	10MHz
Temperature Stability:	±10PPM, 0°C to 50°C
Aging:	±5PPM/year
External Oscillator:	1MHz to 10MHz, 2.5V - 3V peak
Power Requirement:	120VAC/220VAC ± 10%, 20VA
Weight:	Approx. 4.25 lbs (1.932 Kg)

9. Dimensions

Height:	3.9 in. (99.1 mm)
Width:	9.875 in. (250.8 mm)
Depth:	10.5 in. (266.7 mm)

Table 1-2.

SUPPLIES AND ACCESSORIES FURNISHED WITH THE INSTRUMENT

Quantity	Description	Part No.
1	Universal Counter - **712**	12736
1	Universal Counter - **713**	12737
1	Operator's Manual	6-114726
1	Line Cord	5-118916

SECTION II

INSTALLATION

2.1 GENERAL

This section contains instructions for the installation and shipping of the Instrument. Included are unpacking and inspection procedures, warranty, shipping, power source requirements and installation.

2.2 UNPACKING AND INSPECTION

Examine the shipping carton and contents for obvious signs of damage. If damage is visible, do not use the Instrument, but notify the carrier and supplier immediately. If the Instrument appears to be in good condition, read the operator's manual in its entirety and become familiar with the Instrument as instructed in this manual. Proceed to check the electrical performance and check that all items in Table 1-2 are included with the Instrument. Save the carton and packing materials for future storing or shipping of the Instrument.

2.3 SHIPPING

When returning the Instrument for warranty repairs, pack it carefully and ship it prepaid and insured to the desired destination.

2.4 WARRANTY

The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting a warranty repair.

NOTE: For assistance of any kind, including help with the Instrument under warranty, read the warranty printed on the inside front cover of this manual, then contact the dealer or factory. Either will ask for date of purchase, the model and serial number of the unit and a brief description of the problem encountered. Based on the information given, the customer will be advised how to proceed in returning the Instrument for service.

2.5 POWER SOURCE REQUIREMENTS

These Instruments are designed to operate from either a 120 VAC or 220 VAC power source as selected by the power selector switch on back panel.

CAUTION

Ensure that the power source used matches the power requirements of the Instrument as selected by the line voltage switch located on the rear panel.

WARNING

Ensure that the grounding pin of the power plug is securely connected to an earth (powerline) ground. Use a 3-wire grounded outlet which conforms to the latest issue of the National Electrical Code.

2.6 INSTALLATION

The Instrument may be set horizontally on its four rubber feet or at an inclined angle by positioning the 11-position carrying handle under the unit. To set the Instrument at a desirable viewing angle, use the following procedures:

- Pull out both knobs (on sides) of Instrument, 1
- Rotate handle to one of eleven positions, 2
- Push both knobs into a locking position. 1

Figure 2-1. Viewing Adjustment

SECTION III

CONTROLS, CONNECTORS, AND INDICATORS

3.1 GENERAL

All operating and adjustment controls, connectors and indicators are shown in Figures 3-1 and 3-2. Become thoroughly familiar with the name and purpose of each item before operating the instrument.

3.2 FRONT PANEL DESCRIPTION

Description of front panel controls, connectors and indicators are listed in Table 3-1 and shown in Figure 3-1. Figure 3-1 depicts the front panel of the Model 713. The front panel of the Model 712 is similar to the 713, except the Model 712 does not have a Channel C input and the 520MHz RANGE SWITCH is the 200MHz RANGE SWITCH on the Model 712.

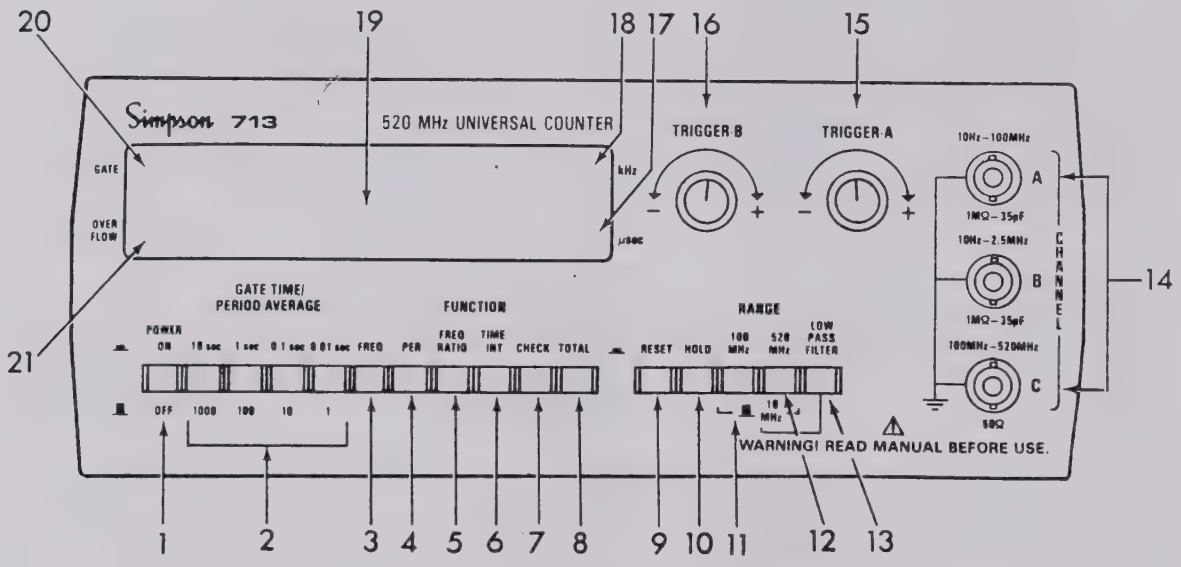


Figure 3-1. Front Panel Description

Table 3-1. Controls, Connectors and Indicators - Front Panel

1. **POWER SWITCH:**	This switch is used to power ON and power OFF the Instrument.	4. **PER SWITCH:**	When this switch is depressed the Instrument is placed in period mode.
2. **GATE TIME/PERIOD AVERAGE:**	This switch is used to Select the gate time/ period average factors.	5. **FREQ RATIO SWITCH:**	Permits measurement of the ratio between the frequency applied to Channel A and the frequency applied to Channel B. The lower frequency signal must be applied to Channel B.
3. **FREQ. SWITCH:**	When this switch is depressed, the Instrument is placed in frequency mode.		

6. **TIME INT SWITCH:** Permits measurement of time interval between two events. The feature operates with Channel A going low at the start of the event to be measured, followed by Channel B going low at the end of the event.

7. **CHECK SWITCH:** Permits checking of internal 10 MHz time base oscillator.

8. **TOTAL SWITCH:** Permits counting of events applied to Channel A.

9. **RESET SWITCH:** When pressed, immediately resets the counter to begin a new measurement. Usually used in the totalize mode to begin a new measurement.

10. **HOLD SWITCH:** Stops the measurement in progress (except for totalize)

11. **RANGE SWITCH: 100MHz** When this switch is depressed, the 100 MHz range is selected.

12. **RANGE SWITCH: 200 MHz - M 712 520 MHz - M 713** This switch is used to select the 200MHz range on the Model 712 or the 520MHz range on the Model 713.

13. **LOW PASS FILTER SWITCH:** Selects low pass filter to eliminate high frequency noise on low frequency signals.

14. **INPUT CONNECTORS:** Provides for application of external signal to Chanel A, B, or C (Model 713) inputs.

15. **TRIGGER A:** Trigger level control used to select the relative voltage at which triggering shall occur on Channel A.

16. **TRIGGER B:** Trigger level control used to select the relative voltage at which triggering shall occur on Channel B.

17. **μs INDICATOR:** Illuminates when the Instrument is in the period or time interval mode.

18. **KHz INDICATOR:** Illuminates when the Instrument is in frequency or check mode.

19. **NUMERIC DISPLAY INDICATOR:** Indicates the magnitude of the signal being measured.

20. **GATE INDICATOR:** Illuminates when the gate is open during a measurement cycle.

21. **OVERFLOW INDICATOR:** Illuminates when the measured signal value exceeds the full scale range.

3.3 REAR PANEL DESCRIPTION

Description of rear panel controls and connectors are listed in Table 3-2 and shown in Figure 3-2.

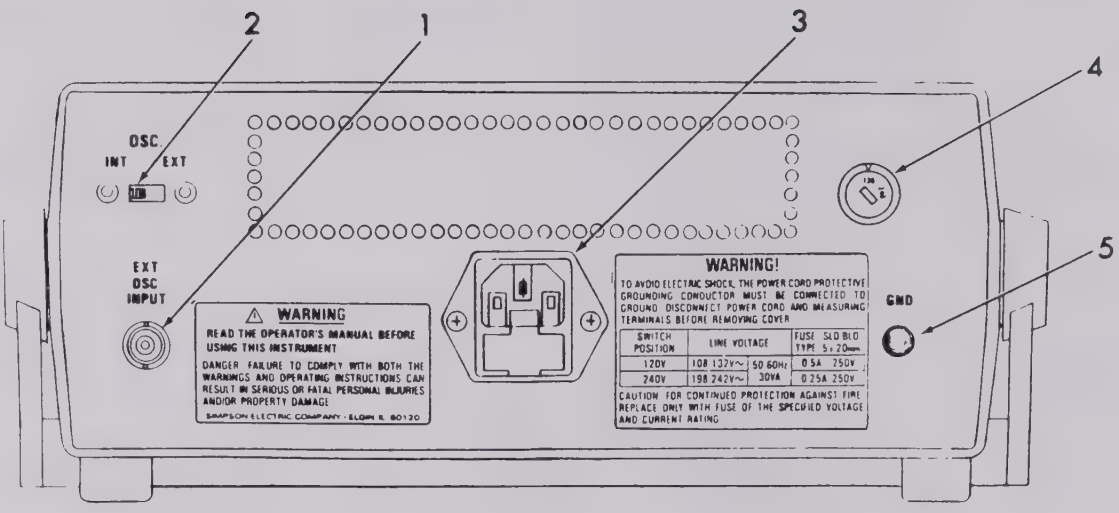


Figure 3-2. Rear Panel Description

Table 3-2. CONTROLS AND CONNECTORS - REAR PANEL

1. EXT OSC INPUT (BNC):	Provides connection to an external oscillator (time base).
2. INT/EXT OSC SWITCH:	Enables the Instrument to operate from either the internal time base (10MHz) or an external source (1MHz to 10 MHz, 2.5 V - 3V peak).
3. AC POWER CONNECTOR/ FUSE HOLDER:	Connects to the AC power line cord supplied with the Instrument.
4 VOLTAGE SELECTOR SWITCH:	Provides for selection of 120V AC or 220V AC.
5. GROUND JACK:	This terminal is electrically connected to the case and the AC line "third-wire" ground.

SECTION IV

OPERATING INSTRUCTIONS

4.1 GENERAL

WARNING

The Instrument is designed to prevent accidental shock when properly used, however, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely prior to making any measurements. Failure to follow directions can result in a serious or fatal accident.

The Model 712 and 713 provide accurate readouts of frequency, period, frequency ratio, time interval and totalize measurements. The following contains all the information related to operation of the Instrument. Special notes and instructions have also been provided for added safety .

Reference is made to switches, indicators, connectors, and controls by the numbers assigned to them in Table 3-1. For your convenience a foldout of the front panel illustration is provided in the back of this manual. The operator should refer to this foldout in order to fully understand the operating instructions described in this section.

4.2 SAFETY PRECAUTIONS

4.2.1 The Instruments are designed to be used only by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury. Refer to SHOCK HAZARD definitions on page ii.

4.2.2 Do not work alone when making measurements where a shock hazard can exist. Notify a nearby person that you are, or intend to make such measurements.

4.2.3 The Instruments are designed to operate from a 3-wire power line outlet that is wired and grounded in accordance with the National Electrical Code. If not certain of the integrity of the outlet ground or if forced to connect to a 2-wire outlet, use a 3-wire to 2-wire plug adapter and be sure to connect the adapter pigtail lead to a known good earth ground for operator safety.

4.2.4 Do not exceed the maximum input voltage ratings of the Instrument, which are tabulated in Table 1-1. To do so endangers personal safety and may also damage the Instrument.

4.2.5 Observe the correct polarity when making connections as the input connector outer shell is grounded to the case and to the power line earth ground.

4.2.6 Do not attempt to float the grounded terminals (the body of the BNC input connector which is electrically connected to the case) or the case of the Instrument above earth or power line ground. To do so risks personal safety and may damage the Instrument as well as the equipment under test.

4.2.7 Remember, voltages might appear unexpectedly in defective equipment. An open bleeder resistor can result in a capacitor retaining a dangerous charge. Remove all power and discharge all capacitors in the circuit being measured before making connections or disconnections.

4.2.8 Locate all voltage sources prior to making any connections.

4.2.9 For your safety, do not touch leads, circuits, or the Instrument, while power is applied to the circuit being measured. Always inspect leads and connectors for cracks, breaks or crazes before each use. If any defects exist replace the defective item immediately.

4.2.10 Use extreme caution when making measurements in an rf circuit, where a dangerous combination of voltages could be present, such as in a modulated rf amplifier.

4.3 FREQUENCY MEASUREMENT PROCEDURE

a. REVIEW SAFETY INFORMATION IN PARAGRAPHS 4.1 and 4.2.

b. Press the POWER switch (1) to ON position.

c. Set INT/EXT OSC switch (see Figure 3-2, Item 2) to INT position.

d. Depress the FREQ FUNCTION switch (3) to select the frequency mode of operation.

e. Select frequency RANGE according to the following chart:

RANGE	SELECTOR SWITCH
10MHz	Both 11 and 12 out
100MHz	11 (IN)
200MHz (Model 712)	12 (IN)
520MHz (Model 713)	12 (IN)

f. Set the GATE TIME/PERIOD AVERAGE switch (2) for desired count (gate) time or time base.

g. Connect signal being measured to the CHANNEL A or CHANNEL C connector, on Model 713, if the frequency is greater than 100MHz.

h. Set TRIGGER A control (15) to the position that gives a consistent and stable reading (For CHANNEL A only).

i. Depress LOW PASS FILTER SWITCH (13) on low frequency signals (10 Hz to 100 KHz) to eliminate high frequency noise.

j. Read frequency from DISPLAY (19) and observe the unit of measurement indication in KHz (18) to the right of the display.

4.4 PERIOD MEASUREMENT PROCEDURE

a. REVIEW SAFETY INFORMATION IN PARAGRAPHS 4.1 and 4.2.

b. Press the POWER switch (1) to ON position.

c. Set INT/EXT OSC switch (see Figure 3-2, Item 2) to INT position.

d. Depress the PER FUNCTION switch (4) to select the Period mode of operation.

e. RANGE switches (11 and 12) should be in the OUT position.

f. Set the GATE TIME/PERIOD AVERAGE switch (2) to the desired period average position(1, 10, 100 or 1000).

g. Connect signal being measured to CHANNEL A connector.

h. Set TRIGGER A control (15) to the position that gives a consistent and stable reading.

i. Depress LOW PASS FILTER switch (13) on low frequency signals (10 Hz to 100 KHz) to eliminate high frequency noise.

j. Read PERIOD from DISPLAY (19) and observe the unit of measurement indication in μsec (17) to the right of the display.

4.5 FREQUENCY RATIO MEASUREMENT PROCEDURE

a. REVIEW SAFETY INFORMATION IN PARAGRAPHS 4.1 and 4.2.

b. Press the power switch (1) to ON position.

c. Set INT/EXT OSC switch (see Figure 3-2, Item2) to INT position.

d. Depress the FREQ RATIO FUNCTION switch (5) to select the frequency ratio mode of operation.

e. RANGE switches (11 and 12) should be in the OUT position.

f. Set the GATE TIME/PERIOD AVERAGE switch (2) to the desired average ratio period position (1, 10, 100 or 1000).

g. Connect the higher frequency signal to CHANNEL A connector and the lower frequency signal to CHANNEL B connector.

h. Set TRIGGER A control (15) and TRIGGER B control (16) to the position that gives a consistent and stable reading.

NOTE: You may set the TRIGGER A control (15) first while the Instrument is in frequency mode of operation and then place the Instrument in frequency ratio mode and set TRIGGER B control (16).

i. Depress LOW PASS FILTER switch (13) on low frequency signals (10 Hz to 100 KHz) to eliminate high frequency noise.

j. Read the Ratio A/B of the two frequencies from DISPLAY (19).

4.6 TIME INTERVAL MEASUREMENT PROCEDURE

a. REVIEW SAFETY INFORMATION IN PARAGRAPHS 4.1 and 4.2.

b. Press the POWER switch (1) to ON position.

c. Set INT/EXT OSC switch (see Figure 3-2, Item 2) to INT position.

d. Depress the TIME INT FUNCTION switch (6) to select the time interval mode of operation.

e. RANGE switches (11 and 12) should be in the OUT position.

f. Set the GATE TIME/PERIOD AVERAGE switch (2) to the desired time interval position (1, 10, 100 or 1000).

g. Connect the pulse signal source to CHANNEL A connector and CHANNEL B connector.

h. The Instrument will effectively measure the elapsed time from the beginning of the pulse until the end of the pulse.

i. Set the TRIGGER A control (15) to the center position or to a position that gives a stable reading while the Instrument is in frequency mode of operation and then switch back to time interval mode.

j. Turn TRIGGER B control (16) fully counter-clockwise and momentarily depress the RESET switch (9). Slowly turn the TRIGGER B control (16) clockwise until you get a stable reading.

NOTE: For an accurage reading you must STOP when you get the first reading.

k. Read time interval from DISPLAY (19) and observe the unit of measurement indication in μsec (17) to the right of the display.

4.7 SELF CHECK PROCEDURE

a. REVIEW SAFETY INFORMATION IN PARAGRAPHS 4.1 and 4.2.

b. Press the POWER switch (1) to ON position.

c. Set INT/EXT OSC switch (see Figure 3-2, Item 2) to INT position.

d. Depress the CHECK FUNCTION switch (7) to select the self check mode of operation.

e. RANGE switches (11 and 12) should be in the OUT position.

f. Set the GATE TIME/PERIOD AVERAGE switch (2) to the desired count gate time or time base .

g. Read 10 MHz frequency from DISPLAY (19).

Table below indicates correct readings with different time bases.

GATE TIME PERIOD AVERAGE POSITION	DISPLAY READING (±1 count)	OVERFLOW INDICATOR
10.0 SEC	0000.0000	ON *
1.0 SEC	10000.000	OFF
0.1 SEC	10000.00	OFF
0.01 SEC	10000.0	OFF

* OFF if display reads 9999.9999

4.8 TOTALIZE PROCDURE

a. REVIEW SAFETY INFORMATION IN PARAGRAPHS 4.1 and 4.2.

b. Press the POWER switch (1) to ON position.

c. Set INT/EXT OSC switch (see Figure 3-2, Item 2), to INT position.

d. Depress the TOTAL FUNCTION switch (8) to select the totalize mode of operation.

e. RANGE switches (11 and 12) should be in the OUT position.

f. Connect event or pulse to CHANNEL A connector.

g. Momentarily depress RESET switch (9) to initalize the counter.

h. Stop the count by depressing the HOLD switch (10).

i If counting does not start, adjust TRIGGER A control (15), until counting starts.

j. Read number of input events or pulses from display (19).

SECTION V

THEORY OF OPERATION

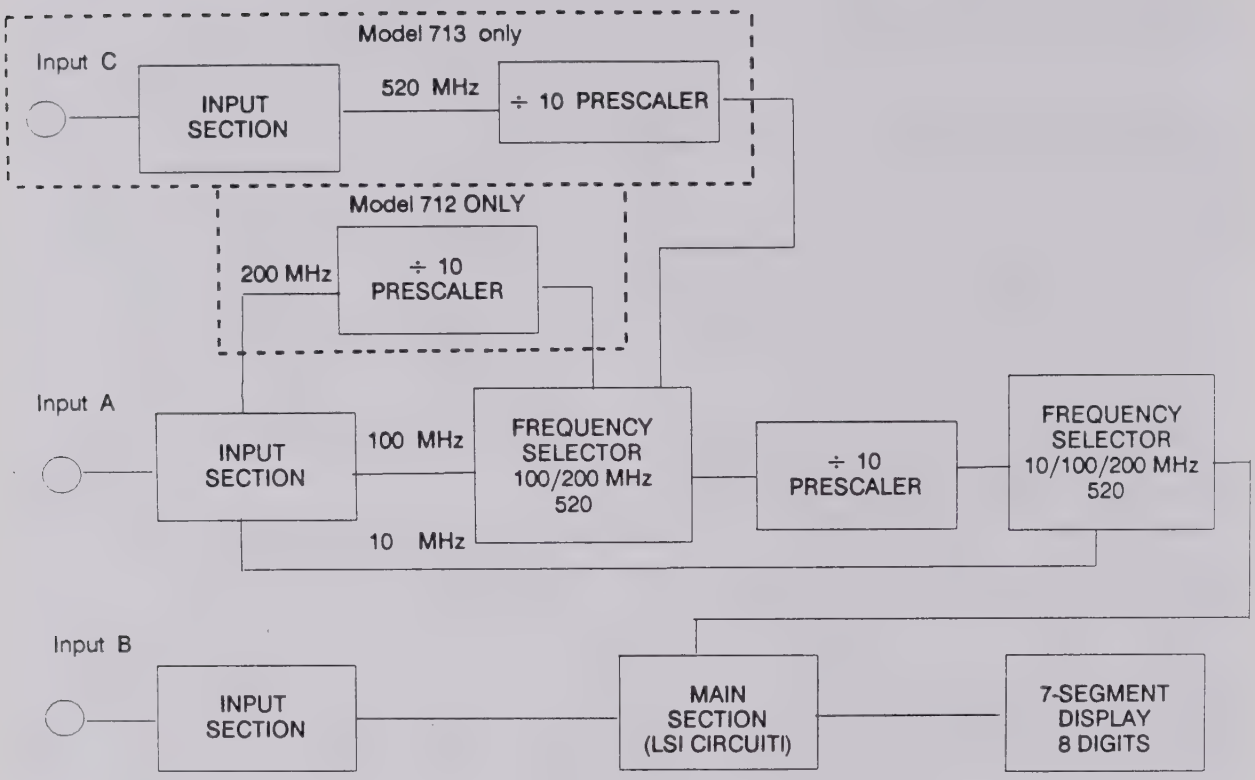


Figure 5-1. Model 712/713 Block Diagram

5.1 GENERAL

This section describes the theory of operation of the Instrument. Figure 5-1 shows the overall block diagram of the Instrument.

5.2 INPUT SECTION

The input signal (A and B) is AC coupled to a wide-band amplifier. Through frequency compensation networks, sufficient gain is maintained for the rated frequency response of the Instrument. Input overload protection is provided by two silicon diodes at the input of the amplifier. Both amplifiers are followed by a schmitt trigger circuit and a level converter, which converts the input signal into a digital signal required for proper interface with the main section (LSI circuit).

5.3 PRESCALER

This section is used when the input frequency is more than 10 MHz. From 10 MHz to 100 MHz is prescaled by ten, and from 100 MHz and up is prescaled by one hundred.

5.4 MAIN SECTION

The main section consists of a LSI circuit that can function as a frequency counter, period counter, frequency ratio (fA/fB) counter, time interval counter or a totalizing counter. It combines a high frequency oscillator, a decade timebase counter, an 8 decade data counter and latches, a 7 segment decoder, digit multiplexer, and segment and digit drivers which can directly drive large LED displays.

SECTION VI

SERVICING INSTRUCTIONS

WARNING

The following Servicing Instructions are for use by qualified personnel only. To avoid electrical shock, do not perform any servicing other than that contained in the operating instructions unless you are qualified to do so.

6.1 GENERAL

This section describes the necessary procedures needed to effectively service the Instrument. Follow these instructions carefully.

6.2 COVER REMOVAL

The top cover can be removed for servicing purposes by the following procedures:

WARNING

Remove all power and connections to the Instrument before removing the case cover. Do not operate the Instrument with the top cover removed.

a. Depress the POWER switch to the (OFF) position.

b. Remove signal input cables and disconnect AC power to the unit.

c. Pull out the knobs (on the sides) of the Instrument and lower the handle toward the bottom of the Instrument.

d. Turn the Instrument over and remove the four (4) screws within the rubber feet.

e. Turn the Instrument to the standing position and remove top cover.

f. Reverse this procedure when replacing the cover.

6.3 FUSE REPLACEMENT

The line fuse is located inside the fuseholder drawer below the power receptacle connector.

WARNING

Remove all power and input/output connections to the Instrument before replacing fuse. Do not replace a blown fuse with one which has a larger rating or slower time lag characterstic than those specified.

Slide open the fuse drawer and replace the fuse with the proper value in accordance with the unit's operating voltage. For 120V power input use a 5x20MM SLO-BLO 250V - .5A fuse. For a 220V power input use a 5x20MM SLO-BLO 250V - .25A fuse.

6.4 CARE

WARNING

Do not attempt to clean this Instrument with the test leads connected to a power source or when it is connected to the AC power line.

6.4.1 Immediately clean all spilled materials from the Instrument and wipe dry. If necessary, moisten a cloth with soap and water to clean plastic surfaces.

6.4.2 Whenever possible, avoid exposure or usage in areas which are subject to temperature and humidity extremes, vibration or mechanical shock, dust or corrosive fumes or strong electrical or electromagnetic interferences.

6.4.3 If the need for calibration is indicated, contact the nearest Authorized Service Center.

6.4.4 Storage: When the Instrument is not in use, store it in a location free from temperature extremes, dust and corrosive fumes, and mechanical vibration or shock.

6.5 CALIBRATION

To calibrate the Instrument, perform the following procedure:

a. Connect the Instrument, and a stable ±1ppm 10MHz source to an appropriate AC power source and apply power. Allow one hour warm up for both units. The Instrument must have top cover in place during warm up.

b. Set Instrument controls as follows: (see Figure 3-1)

   1. Depress the FREQ FUNCTION switch (3)
   2. RANGE switches (11 and 12) should be in the OUT position.
   3. INT/EXT OSC switch (see Figure 3-2, Item 2) to INT position.
   4. TRIGGER A control (15) to the center position or adjust for stable reading.
   5. GATE TIME/PERIOD AVERAGE switch (2) to the one (1) sec position.

c. Connect the CHANNEL A connector to the 10MHz source.

d. Remove the top cover. Using an insulated screw driver, adjust the trimmer capacitor, C139 (see Figure 6-1), so that unit reads 10000.000 ± 1 digit.

e. Replace the cover and check the reading again.

6.6 REPLACEMENT PARTS AND SCHEMATIC DIAGRAM

6.6.1 Table 6-1 lists repair parts with their reference designators and indicates their description. (Refer to Table 1-2 for Items and Accessories Furnished with these Instruments.)

6.6.2 To obtain replacement parts, address order to the nearest Authorized Service Center. Refer to paragraph 2.4.1 for ordering instructions.

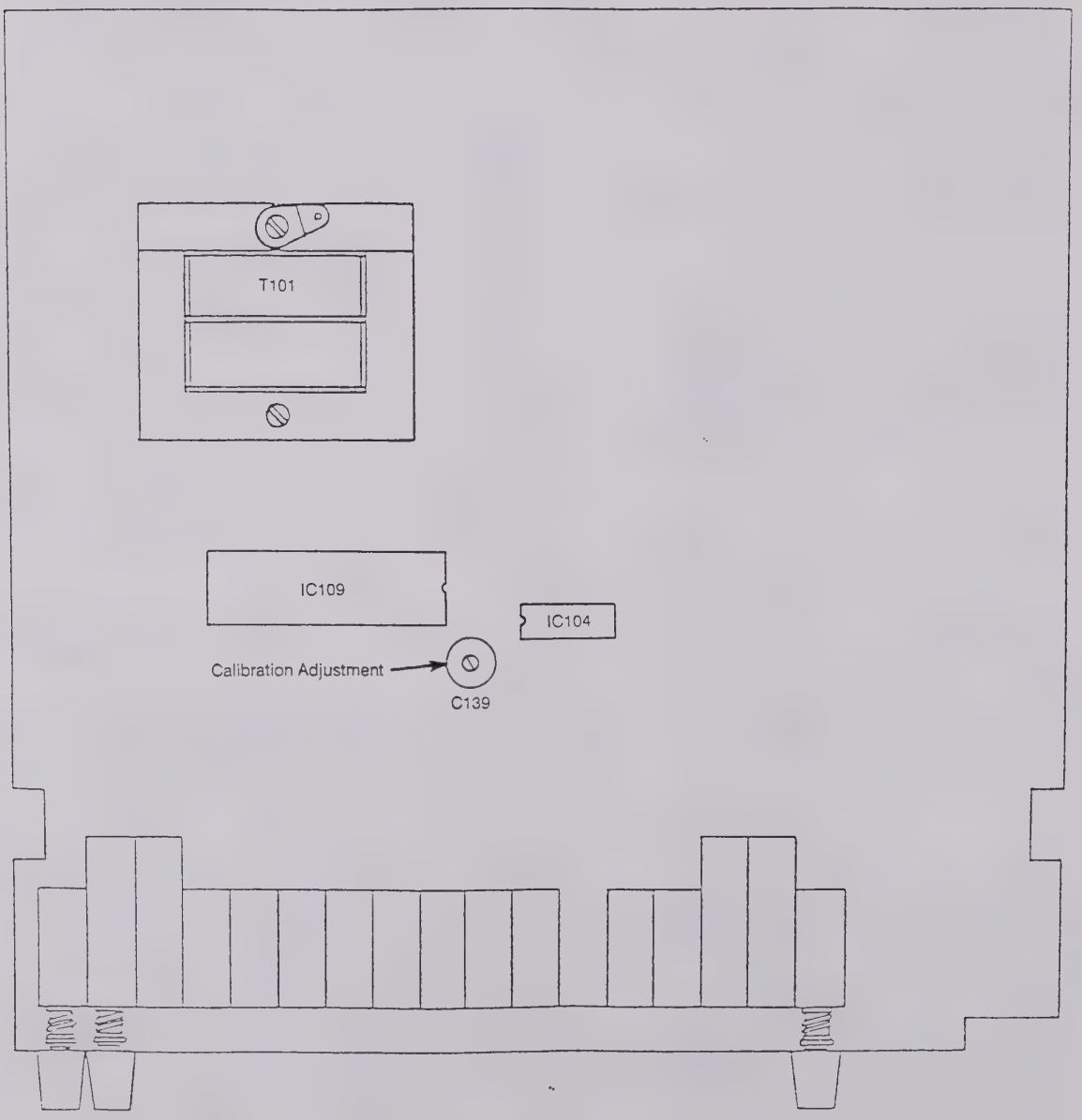


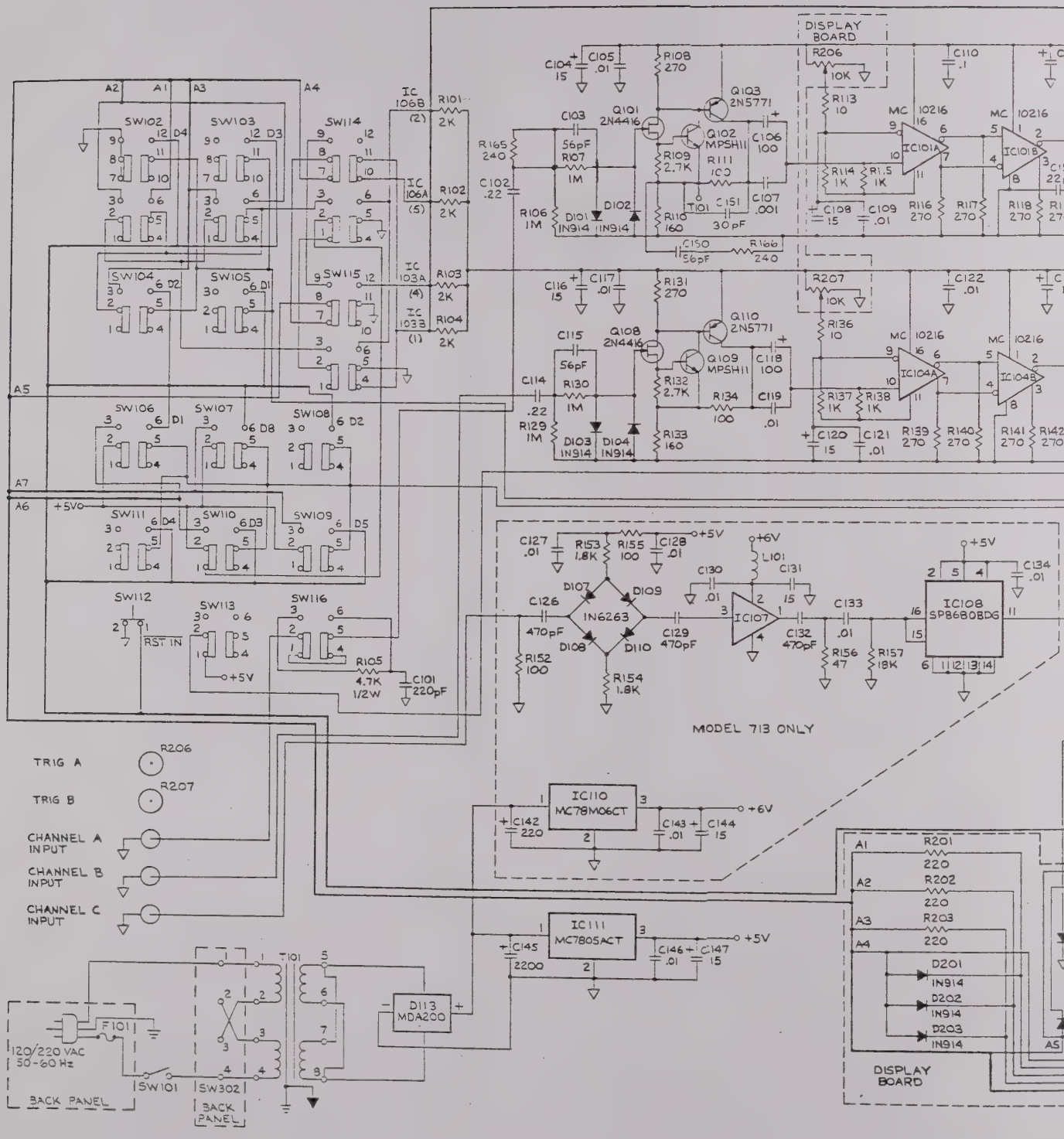
Figure 6-1. Calibration Adjustment

Table 6-1. Replacement Parts

Symbol	Description	Part No.
C101	Capacitor, DC, 220pF, 500V	5-112691
C102	Capacitor, DC, 0.22μF, 250V,10%, MP	6-110364
C103	Capacitor, DC, 56pF, 1000V	5-110934
C104	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C105	Capacitor, DC, 0.01μF, 100V	5-113215
C106	Capacitor, Lytic Alum, 100μF, 10V	5-117206
C107	Capacitor, DC, 0.001μF, 500V	5-111425
C108	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C109,	Capacitor, DC, 0.01μF, 100V	5-113215
C110	Capacitor, 0.1μF, 50V	5-118660
C111	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C112, C113	Capacitor, DC, 0.01μF, 100V	5-113215
C114	Capacitor, DC, .22μF, 250V, 10%, MP	6-110364
C115	Capacitor, DC, 56pF, 1000V	5-110934
C116	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C117	Capacitor, DC, 0.01μF, 100V	5-113215
C118	Capacitor, Lytic Alum, 100μF, 10V	5-117206
C119	Capacitor, DC, 0.001μF, 500V	5-111425
C120	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C121, C122	Capacitor, DC, 0.01μF, 100V	5-113215
C123	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C124, C125	Capacitor, DC, 0.01μF, 100V	5-113215
C126	Capacitor, DC, 470pF, 500V	1-115832
C127, C128	Capacitor, DC, 0.01μF, 100V	5-113215
C129	Capacitor, DC, 470pF, 500V	1-115832
C130	Capacitor, DC, 0.01μF, 100V	5-113215
C131	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C132	Capacitor, DC, 470pF, 500V	1-115832
C133, C134	Capacitor, DC, 0.01μF, 100V	5-113215
C135	Capacitor, DC, 39pF,1000V, NPO	5-118561
C136	Capacitor, DC, 0.1μF, 50V	5-119660
C137	Capacitor, DC, 39pF, 1000V, NPO	5-118561
C138	Capacitor, DC, 6.8pF, 1000V	5-110057
C139	Capacitor, Variable, 2-22pF	5-119576
C140	Capacitor, DC, 0.01μF, 100V	5-113215
C141	Capacitor, Lytic Tant, 3.3μF, 10V	5-117605
C142	Capacitor, Lytic Alum, 220μF, 25V	6-111949
C143	Capacitor, DC, 0.01μF, 100V	5-113215
C144	Capacitor, Lytic Tant, 15μF, 16V	5-115535
C145	Capacitor, Lytic Alum, 2200μF, 16V	5-118084
C146	Capacitor, DC, 0.01μF, 100V	5-113215
C147	Capacitor, Lytic Tant, 15μF, 16V	5-115534
C148	Capacitor, Lytic Tant, 3.3μF, 10V	5-117605
C149	Capacitor, DC, 0.1μF, 50V	5-119660
C150	Capacitor, 56pF, 100V, 10%, CD	5-110934
C151	Capacitor, 30pF, 50V, 10%, CD	5-119320
C152	Capacitor, 22pF, 100V, 10%, CD	5-117200

Symbol	Description	Part No.
D101 - D106	Diode, 1N914	5-112004
D107 - D110	Diode, 1N6263	3-813018
D111	Diode, 1N914	5-112004
D113	Bridge Rectifier, MDA200	6-111240
D201, D203,	Diode, 1N914	5-112004
F1	Fuse, 1/2A, 250V, 5X20MM SLO BLO (For 120V Model)	6-114514
	Fuse, 1/4A, 250V, 5X20MM SLO BLO (For 220V Model)	6-114513
IC101	IC, 10216, Line Receiver	6-114157
IC102	IC, SP8680BDG OR11C90	6-114158
IC103	IC, SN74S00, Nand Gate	5-117146
IC104	IC, 10216, Line Receiver	6-114157
IC105	IC, SN74S196, Decade Cntr.	5-117147
IC106	IC, SN74S00, Nand Gate	5-117146
IC107	IC, NE5205EC, High Freq. Amp.	6-114159
IC108	IC, SP8680BDG OR11C90	6-114158
IC109	IC, ICM7226BIPL, Freq. Ctr.	6-114160
IC111	IC, 7805, 5V Reg.	5-117149
L101	Coil, Choke, 10μH, 335mA	
Q101	Transistor, 2N4416, FET N-CH	6-110373
Q102	Transistor, MPS-11, NPN	5-118127
Q103 - Q107	Transistor, 2N5771, PNP	5-117827
Q108	Transistor, 2N4416, FET N-CH	6-110373
Q109	Transistor, MPS-H11, NPN	5-118127
Q110	Transistor, ICM67806CT	6-113740
Q111, Q112	Transistor, 2N5571, PNP	5-117827
Q113	Transistor, 2N2907, PNP	5-116198
R101 - R104	Resistor, 2KΩ, 5%, 1/4W, CF	6-110093
R105	Resistor, 4.7KΩ, 5%, 1/2W, CF	5-118609
R106, R107	Resistor, 1MΩ, 5%, 1/4W, CF	5-118305
R108	Resistor, 270Ω, 5%, 1/4W, CF	6-110163
R109	Resistor, 2.7KΩ, 5%, 1/4W, CF	5-119764
R110	Resistor, 160Ω, 5%, 1/4W, CF	6-110362
R111	Resistor, 100Ω, 5%, 1/4W, CF	5-118152
R113	Resistor, 10Ω, 5%, 1/4W, CF	5-119670
R114, R115	Resistor, 1KΩ, 5%, 1/4W, CF	5-118155
R116 - R119	Resistor, 270Ω, 5%, 1/4W, CF	6-110163
R120	Resistor, 510Ω, 5%, 1/4W, CF	5-114965
R121	Resistor, 160Ω, 5%, 1/4W, CF	6-110362
R122	Resistor, 130Ω, 5%, 1/4W, CF	6-110361
R123, R124	Resistor, 39Ω, 5%, 1/4W, CF	6-110360
R125	Wire, Jumper, Molded	6-112837
R126, R127	Resistor, 510Ω, 5%, 1/4W, CF	5-114965
R128	Resistor, 3KΩ, 5%, 1/4W, CF	5-117952
R129, R130	Resistor, 1MΩ, 5%, 1/4W, CF	5-118305
R131	Resistor, 270Ω, 5%, 1/4W, CF	6-110163
R132	Resistor, 2.7KΩ, 5%, 1/4W, CF	5-119764

Symbol	Description	Part No.
R133	Resistor, 160Ω, 5%, 1/4W, CF	6-110362
R134	Resistor, 100Ω, 5%, 1/4W, CF	5-118152
R136	Resistor, 10Ω, 5%, 1/4W, CF	5-119670
R137, R138	Resistor, 1KΩ, 5%, 1/4W, CF	5-118155
R139, R140,	Resistor, 270Ω, 5%, 1/4W, CF	6-110163
R141 - R144	Resistor, 510Ω, 5%, 1/4W, CF	5-114965
R145	Resistor, 39Ω, 5%, 1/4W, CF	6-110360
R146	Resistor, 510Ω, 5%, 1/4W, CF	5-114965
R147	Wire, Jumper, Molded	6-112837
R148, R149	Resistor, 560Ω, 5%, 1/4W, CF	5-118154
R150		
R151	Resistor, 3KΩ, 5%, 1/4W, CF	5-117952
R152	Resistor, 100Ω, 5%, 1/4W, CF	5-118152
R153, R154	Resistor, 1.8K, 5%, 1/4W, CF	5-119763
R155	Resistor, 100Ω, 5%, 1/4W, CF	5-118152
R156	Resistor, 47Ω, 5%, 1/4W, CF	5-118151
R157	Resistor, 18KΩ, 5%, 1/4W, CF	5-119644
R158, R159	Resistor, 10KΩ, 5%, 1/4W, CF	5-118161
R160	Resistor, 1KΩ, 5%, 1/4W, CF	5-118155
R161	Resistor, 300Ω, 5%, 1/4W, CF	5-119630
R162	Resistor, 10KΩ, 5%, 1/4W, CF	5-118161
R163	Resistor, 100KΩ, 5%, 1/4W, CF	5-118168
R164	Resistor, 22MΩ, 5%, 1/4W, CF	5-118756
R165	Resistor, 240Ω, 5%, 1/4W, CF	6-110523
R166	Resistor, 240Ω, 5%, 1/4W, CF	6-110523
R201 - R203	Resistor, 220Ω, 5%, 1/4W, CF	5-118306
R204, R205	Resistor, 510Ω, 5%, 1/4W, CF	5-114965
R206, R207	Resistor, Variable, 10KΩ	6-114120
T101	Transformer, Power	6-114100
X101	Crystal, 10.000 MHz	6-114154
D204, D206,	Diode, LED, Orange	6-114135
D207		
D205	Diode, LED, Red	6-114245
	Display, Set, LED, 8 Digit, Orange	6-114136
	Switch, Push Button, 17 Station	6-114113
	Button, Push, Molded, Gray	3-261211
	Button, Push, Molded, Red	3-261206


DISPLAY BOARD
SW102
SW103
SW114
SW104
SW105
SW115
SW106
SW107
SW108
SW111
SW110
SW109
SW112
SW113
SW116
RST IN
+5VO
TRIG A
TRIG B
CHANNEL A INPUT
CHANNEL B INPUT
CHANNEL C INPUT
MODEL 713 ONLY
IC108 SP8680BDG
IC110 MC78M06CT
IC111 MC7805ACT
IC101A
IC101B
IC104A
IC104B
MC 10216
D113 MDA200
F101
120/220 VAC 50-60 Hz
SW101
SW302
BACK PANEL
DISPLAY BOARD

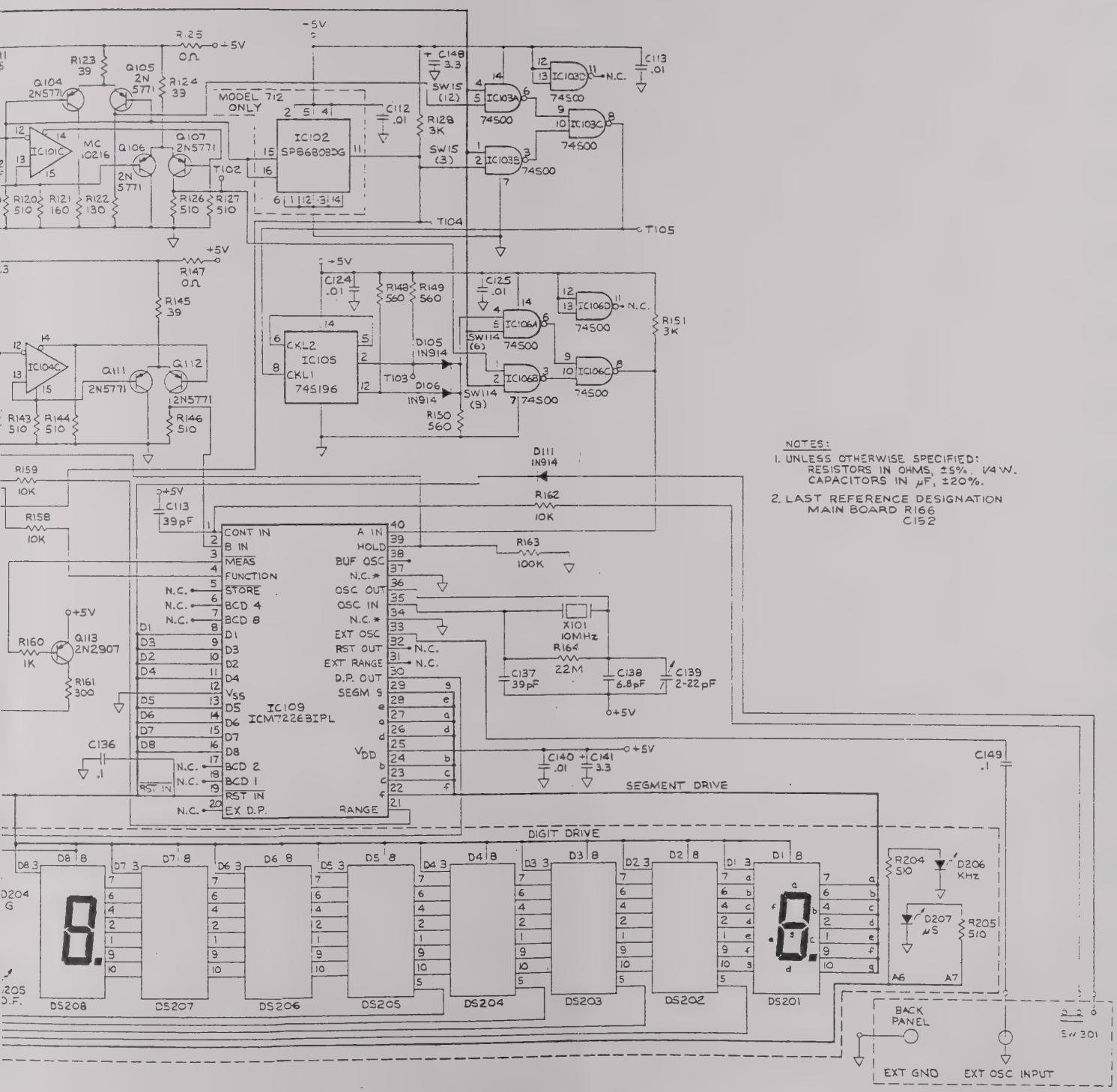


Figure 6-2. Model 712/713 Schematic Diagram

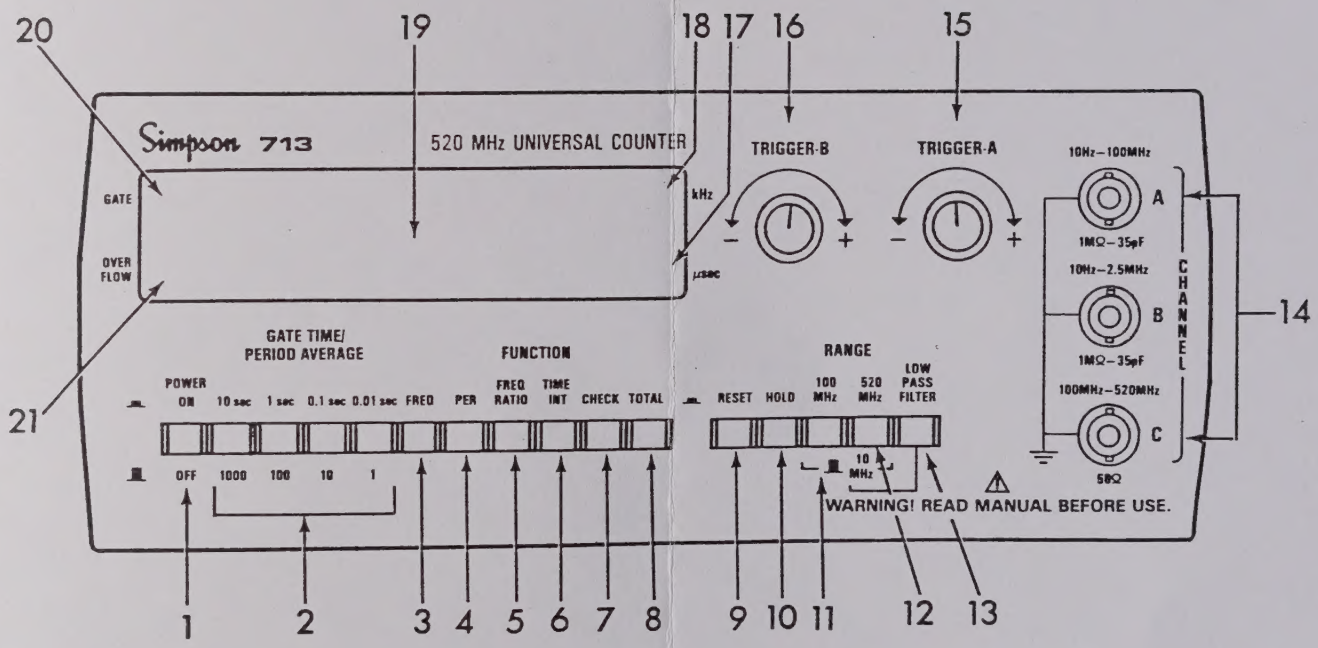


Figure 3-1. Front Panel Description

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